

APPENDIX

MODEL DESCRIPTION

SETS

c	set of commodities
a	set of sectors
f	set of factors
h	set of households
insd	set of institutions

PARAMETERS

alphaq(c)	Armington function shift parameter for commodity c
alphat(c)	CET function shift parameter for commodity c
alphava(a)	shift parameter for CES activity production function
betam(c, h)	marginal share of household consumption spending on commodity c
cwts(c)	weight of commodity c in the consumer price index
deltaq(c)	Armington function share parameter for commodity c
deltat(c)	CET function share parameter for commodity c
deltava(f, a)	share parameter for CES activity production function
gammam(c, h)	per capita subsistence consumption of marketed commodity c for household h
ica(c, a)	quantity of c as intermediate input per unit of aggregate intermediate
mpsbar(h)	marginal or average propensity to save
qbarinv(c)	base-year quantity of investment demand for commodity c
rhoq(c)	Armington function exponent for commodity c
rhot(c)	CET function exponent for commodity c
rhova(a)	CES activity production function exponent
shif(insd, f)	share of institution insd in the income of factor f
trnsfr(insd, insd)	inter institutional transfers
tinsbar(h)	direct tax rate for household h
tradelarm(c)	Armington elasticity for commodity
tradelcet(c)	CET elasticity for commodity
alphava2(c)	shift parameter for CES function for rural and urban labour
deltava2(c)	share parameter for CES function for rural and urban labour
rhova2(c)	exponent of CES function for rural and urban labour
gammam(c, h)	per capita subsistence consumption of commodity c for household h
tst(c)	sales tax
texc(a)	excise duty
tstm(c)	stamp duty
toth(c)	other taxes
tser(c)	service tax
tsub(a)	subsidy rate
tm(c)	import tariff
te(c)	export tariff
inta(a)	intermediate aggregate coefficient of Leontief production function
iva(a)	aggregate value added coefficient of Leontief production function
mps0(h)	marginal (and average) propensity to save for household h

VARIABLES

CPI	consumer price index (fixed variable)
EG	government expenditure
EH (h)	household consumption expenditure
EXR	exchange rate (domestic currency per unit of foreign currency)
GSAV	government savings
IADJ	investment adjustment factor
MPS (h)	marginal (and average) propensity to save for household (fixed variable)
PDD (c)	demand price of output produced and sold domestically
PDS (c)	supply price of output produced and sold domestically
PINTA (a)	price of intermediate aggregate
PE (c)	export price
PM (c)	import price
PWE (c)	world price of exported commodity (fixed variable)
PWM (c)	world price of imported commodity (fixed variable)
PQ (c)	composite commodity price
PVA (a)	value-added price
PX (c)	producer price for commodity
QD (c)	quantity sold domestically of domestic output
QE (c)	export quantity
QF (f, a)	quantity demanded of factor f from activity a
QVA (a)	quantity of aggregate value added
QH (c, h)	quantity consumed of commodity c by household h
QINT (c, a)	quantity of commodity c used as intermediate input in activity a
QINTA (a)	quantity of aggregate intermediate input for activity a
QINV (c)	quantity of investment demand for commodity c
QM (c)	import quantity
QQ (c)	quantity of goods supplied domestically (composite supply)
QX (a)	quantity of domestic output of commodity c
TABS	total absorption
TINS (h)	direct tax rate (fixed variable)
WF (f)	economy-wide wage of factor f
WFDIST (f, a)	wage distortion factor for factor f in activity a
YF (f)	factor income
YG	government income
YIF (insd, f)	income of institution insd from factor f
YI (insd)	income of institution insd
CORPSAV	corporate saving
QFS (f)	factor supply
PVTENTSAV	private enterprise savings
PUBENTSAV	public enterprise savings
FSAV	foreign savings (fixed variable)
WALRAS	variable introduced to equalize number of variables and equations
QFLAB (a)	aggregate labour in activity a
WFLAB (a)	wage of aggregate labour in activity a
NREGTRNSFR	transfers to poor rural households due to MGNREGA
NREGATAX	additional tax rate to finance MGNREGA transfers

MODEL EQUATIONS

1. Import price

$$PM(c) = (1 + \text{indtax}(c, 'tm')) * EXR * \text{pwm}(c)$$

2. Export price

$$PE(c) = (1 - \text{indtax}(c, 'te')) * EXR * \text{pwe}(c)$$

3. Domestic price equilibrium

$$PDD(c) = PDS(c)$$

4. Consumption value (net of taxes)

$$PQ(c) * (1 - \text{indtax}(c, 'tsal') - \text{indtax}(c, 'tstm') - \text{indtax}(c, 'toth') - \text{indtax}(c, 'tser')) * QQ(c) \\ = PDD(c) * QDD(c) + PM(c) * QM(c)$$

5. Production value

$$PX(c) * QX(c) = PDS(c) * QD(c) + PE(c) * QE(c)$$

6. Aggregate price of intermediate inputs for sector

$$PINTA(a) = \sum_c PQ(c) * \text{ica}(c, a)$$

7. Production value (net of taxes)

$$PX(a) * QX(a) * (1 - \text{indtax}(a, 'text') + \text{indtax}(a, 'tsub') + \text{nregatax}) = \\ PVA(a) * QVA(a) + PINTA(a) * QINTA(a)$$

8. Consumer price index

$$\text{cpi} = \sum_c \text{cwts}(c) * PQ(c)$$

9. Aggregate intermediate input quantity for sector

$$QINTA(a) = \text{inta}(a) * QX(a)$$

10. Aggregate value added quantity for sector

$$QVA(a) = \text{iva}(a) * QX(a)$$

11. Constant elasticity of substitution (CES) function for aggregate value added (capital and aggregate labour)

$$QVA(a) = \text{alphava}(a) * (\text{deltava}('CAP',a) * QF('CAP',a)^{-\text{rhova}(a)} + (1 - \text{deltava}('CAP',a)) * QFLAB(a)^{-\text{rhova}(a)})^{\frac{1}{\text{rhova}(a)}}$$

12. First order condition for aggregate value added

$$QF('CAP',a) = QFLAB(a) * ((WFLAB(a) / (WF('CAP') * WFDIST('CAP',a))) * (\text{deltava}('CAP',a) / (1 - \text{deltava}('CAP',a))))^{\frac{1}{1 + \text{rhova}(a)}}$$

13. Euler's equation for aggregate value added

$$QVA(a) * PVA(a) = QFLAB(a) * WFLAB(a) + QF('CAP',a) * WF('CAP') * WFDIST('CAP',a)$$

14. Constant elasticity of substitution (CES) function for aggregate labour (urban and rural labour)

$$QFLAB(a) = \text{alphava2}(a) * (\text{deltava2}(a) * QF('RLAB',a)^{-\text{rhova2}(a)} + (1 - \text{deltava2}(a)) * QF('ULAB',a)^{-\text{rhova2}(a)})^{\frac{1}{\text{rhova2}(a)}}$$

15. First order condition for aggregate labour

$$QF('RLAB',a) = QF('ULAB',a) * ((WF('ULAB') / (wf0('RLAB')))) * (\text{deltava2}(a) / (1 - \text{deltava2}(a)))^{\frac{1}{1 + \text{rhova2}(a)}}$$

16. Euler's equation for aggregate labour

$$QFLAB(a) * WFLAB(a) = QF('RLAB',a) * wf0('RLAB') + QF('ULAB',a) * WF('ULAB')$$

17. Intermediate input quantity for sector

$$QINT(c,a) = \text{ica}(c,a) * QINTA(a)$$

18. Armington function for imported and domestic goods

$$QQ(c) = \text{alphaq}(c) * (\text{deltaq}(c) * QM(c)^{-\text{rhoq}(c)} + (1 - \text{deltaq}(c)) * QD(c)^{-\text{rhoq}(c)})^{\frac{1}{\text{rhoq}(c)}}$$

19. First order condition for Armington function

$$QM(c) = QD(c) * (PDD(c) / PM(c)) * (\text{deltaq}(c) / (1 - \text{deltaq}(c)))^{\frac{1}{1 + \text{rhoq}(c)}}$$

20. Constant elasticity of transformation (CET) function for exported and domestic goods

$$QX(c) = \text{alphan}(c) * (\text{deltat}(c) * QE(c)^{\text{rhot}(c)} + (1 - \text{deltat}(c)) * QD(c)^{\text{rhot}(c)})^{\frac{1}{\text{rhot}(c)}}$$

21. First order condition for CET function

$$QE(c) = QD(c) * (PE(c)/PDS(c) * (1 - \text{deltat}(c)) / \text{deltat}(c))^{\frac{1}{\text{rho}(c)-1}}$$

22. Demand supply equilibrium for non imported goods

$$QQ(c) = QD(c)$$

23. Demand supply equilibrium for non exported goods

$$QX(c) = QD(c)$$

24. Factor income (capital)

$$YF('CAP') = \sum_a WF('CAP') * WFDIST('CAP',A) * QF('CAP',A)$$

25. Factor income (rural labour)

$$YF('RLAB') = \sum_a wf0('RLAB') * QF('RLAB',A)$$

26. Factor income (urban labour)

$$YF('ULAB') = \sum_a WF('ULAB') * QF('ULAB',A)$$

27. Institutional income from rural labour

$$YIF(\text{insd}, 'RLAB') = \text{shif}(\text{insd}, 'RLAB') * (YF('RLAB') - \text{trnsfr}('ROW', 'RLAB') * \text{EXR})$$

28. Institutional income from urban labour

$$YIF(\text{insd}, 'ULAB') = \text{shif}(\text{insd}, 'ULAB') * (YF('ULAB') - \text{trnsfr}('ROW', 'ULAB') * \text{EXR})$$

29. Institutional income from capital

$$YIF(\text{insd}, 'CAP') = \text{shif}(\text{insd}, 'CAP') * (YF('CAP') - \text{trnsfr}('ROW', 'CAP') * \text{EXR} - \text{CORPSAV})$$

30. Rural household income

$$YI(\text{RH}) = \sum_f YIF('RH1', f) + \text{trnsfr}('RH1', 'GOVT') * \text{cpi} + \text{trnsfr}('RH1', 'ROW') * \text{EXR} + \text{popshr} * \text{nregtrnsfr}$$

31. Urban household income

$$YI(UH) = \sum_f YIF('UH1',f) + \text{trnsfr}('UH1',GOVT)*CPI + \text{trnsfr}('UH1',ROW)*EXR$$

32. Household expenditure net of savings and direct taxes

$$EH(h) = (1-MPS(h))*(1-TINS(h)-nregatax)*YI(h)$$

33. Linear expenditure system (LES)

$$PQ(c)*QH(c,h) = PQ(c)*\text{gammam}(c,h) + \text{betam}(c,h)*(EH(h) - \sum_c PQ(c)*\text{gammam}(c,h))$$

34. Investment demand quantity

$$QINV(c) = \text{qbarinv}(c)*IADJ$$

35. Government income

$$\begin{aligned} YG = & \sum_h TINS(h)*YI(h) + nregatax* \sum_h YI(h) + \sum_a \text{indtax}(a,'texc')*PX(a)*QX(a) + \\ & \sum_c \text{indtax}(c,'tm')*pwm0(c)*QM(c)*EXR + \sum_c \text{indtax}(c,'tsal')*PQ(c)*QQ(c) + \\ & \sum_c \text{indtax}(c,'tstm')*PQ(c)*QQ(c) + \sum_c \text{indtax}(c,'toth')*PQ(c)*QQ(c) + \\ & \sum_c \text{indtax}(c,'tser')*PQ(c)*QQ(c) + \sum_c \text{indtax}(c,'te')*pwe0(c)*QE(c)*EXR - \\ & \sum_a \text{indtax}(a,'tsub')*PX(a)*QX(a) + YIF('GOVT','CAP') + \text{trnsfr}('GOVT','PVTENT')*cpi \\ & + \text{trnsfr}('GOVT','ROW')*EXR \end{aligned}$$

36. Government expenditure

$$EG = \sum_c PQ(c)*QG0(c,'GOVT') + \sum_h \text{trnsfr}(h,'GOVT')*cpi + \text{trnsfr}('PVTENT','GOVT')*cpi + NREGTRANSFR$$

37. Transfers financed through household taxes

$$NREGTRANSFR = NREGATAX* \sum_h YI(h)$$

38. Aggregate rural labour supply

$$QFS('RLAB') = \sum_a QF('RLAB',a)$$

39. Aggregate urban labour supply

$$QFS('ULAB') = \sum_a QF('ULAB',a)$$

40. Aggregate capital supply

$$QFS('CAP') = \sum_a QF('CAP',a)$$

41. Total commodity demand

$$QQ(C) = \sum_a QINT(c,a) + \sum_h QH(c,h) + QGO(c,'GOVT') + QINV(c)$$

42. Current account balance

$$\begin{aligned} & \sum_{c \in ce} pwe(c) * QE(c) + \sum_{ins} \text{trnsfr}(ins, 'row') + fsav \\ &= \sum_{c \in cm} pwm(c) * QM(C) + \sum_f \text{trnsfr}('row', f) \end{aligned}$$

43. Government savings

$$GSAV = YG - EG$$

44. Direct tax rate for households

$$TINS(h) = \text{tinsbar}(h)$$

45. Retained earnings of firms

$$CORPSAV = YF('CAP') - \text{trnsfr}('ROW', 'CAP') * EXR - \sum_{insd} YIF(insd, 'CAP')$$

46. Total absorption

$$TABS = \sum_c \sum_h PQ(C) * QH(C,H) + \sum_c PQ(C) * QGO(C, 'GOVT') + \sum_c PQ(C) * QINV(c)$$

47. Savings of private firms

$$PVTENTSAV = YIF('PVTENT', 'CAP') + \text{trnsfr}('PVTENT', 'GOVT') * cpi - \text{trnsfr}('GOVT', 'PVTENT') * cpi$$

48. Savings of government firms

$$\text{PUBENTSAV} = \text{YIF}(\text{'PUBENT'}, \text{'CAP'})$$

49. Savings-investment balance

$$\text{SUM}(c, \text{PQ}(c) * \text{QINV}(c)) = \text{GSAV} + \sum_h \text{MPS}(h) * \text{YI}(h) * (1 - \text{TINS}(h) - \text{nregatax}) + \text{CORPSAV} \\ + \text{PVTENTSAV} + \text{PUBENTSAV} + \text{EXR} * \text{fsav} + \text{WALRAS}$$

50. Marginal propensity to save for households

$$\text{MPS}(h) = \text{mps0}(h)$$